UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/995,187	11/27/2001	Andrew Connell	6544-1003	9368

7590 08/09/2004

John W. Hayes
Dykema Gossett Rooks Pitts PLLC
10 South Wacker Drive
Suite 2300
Chicago, IL 60606

EXAMINER	
MARKHAM, WESLEY D	
ART UNIT	PAPER NUMBER
1762	

DATE MAILED: 08/09/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	**Application No.**	**Applicant(s)**	
	09/995,187	CONNELL ET AL.	
	Examiner	**Art Unit**	
	Wesley D Markham	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 10 June 2004.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-22 is/are pending in the application.

4a) Of the above claim(s) 22 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-21 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 27 November 2001 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election of Group I, Claims 1 – 21, drawn to a process for forming a material with at least two regions of differing refractive index, in the reply filed on 6/10/2004 (with a certificate of mailing dated 6/7/2004) is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). Claim 22 is withdrawn from further consideration by the examiner as being drawn to a non-elected invention. An Office Action on the merits follows.

Priority

2. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Europe on 11/28/2000. It is noted, however, that applicant has not filed a certified copy of the EP 00650200.9 application as required by 35 U.S.C. 119(b).

Drawings

3. The formal drawings (2 sheets, 7 figures) filed by the applicant on 11/27/2001 are acknowledged.
4. The drawings are objected to for the following reasons:

- Figures 1 – 6: The figures are too light in some portions and too dark in other portions, thereby making it difficult to discern what that figures intend to show.
- Figures 1 – 3: There are numerous "arrows" in the figures that appear to point to various elements in the figures but lack any kind of modifying reference numbers / characters, thereby rendering the figures confusing.
- The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference character(s) mentioned in the description: "3", "12", and "13".
- The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "1" has been used to designate what appear to be a number of different structural elements in Figures 4 – 6.

5. Corrected drawing sheets are required in reply to the Office Action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion

of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office Action. The objection to the drawings will not be held in abeyance.

Specification

6. The lengthy specification (29 pages, exclusive of the claims) has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.
7. The disclosure is objected to because of the following informalities: On page 18, line 10, the word, "refractive" appears to be misspelled, "refractiv". Appropriate correction is required.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 9 and 12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
10. **Claim 9** recites, in part, "...one of the methods selected from the group consisting of: irradiation, exposure to elevated temperatures or by exposure to electron or ion

beams." This is improper Markush group language which renders the scope of Claim 9 unclear and the claim vague and indefinite (i.e., because a group should consist of a number of various elements – "A, B, <u>and</u> C" – not a single element – "A, B, <u>or</u> C"). For the purposes of examination, the examiner has interpreted the aforementioned limitation to be equivalent to, "...one of the methods selected from the group consisting of: irradiation, exposure to elevated temperatures, <u>and</u> exposure to electron or ion beams." For further discussion on Markush group practice, see MPEP 2173.05(h).

11. **Claim 12** recites the limitation, "the polymerisable component" in line 1 of the claim. There is insufficient antecedent basis for this limitation in the claim. Specifically, neither Claim 12 nor Claim 1 (from which Claim 12 depends) previously recites or refers to a "polymerisable component". Therefore, it is unclear to what component the claim refers, and the scope of the claim is vague and indefinite. For the purposes of examination, that examiner has interpreted "the polymerisable component" to be equivalent to "the gelable component" recited in Claim 1.

Claim Observations

12. Regarding Claims 12, 17, and 18, the examiner notes that the transitional phrases "including" and "such as" have been interpreted to be exemplary, not limiting. For example, Claim 12 has been interpreted to be open to any alkyl or acyl substituted alkoxysilane, not limited to the specific compounds recited in the claim following the term "including".

Claim Rejections - 35 USC § 102

13. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

14. Claims 1 – 13, 16, 18, 20, and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Fardad et al. (USPN 6,054,253).

15. Regarding independent **Claims 1 and 20**, Fardad et al. teaches a process for forming an optical waveguide (Abstract), the process comprising the steps of (1) forming a buffer layer on a desired substrate (Col.5, lines 31 – 35), (2) applying a "gelable composition comprising a gelable component" (i.e., a photosensitive sol-gel material) to the buffer layer so that the gelable composition is in a desired form, (3) exposing the gelable composition to conditions which partially gel the gelable composition so that an amount of ungelled material remains (i.e., the pre-baking process), (4) exposing at least one discrete area of the partially gelled product to conditions which induce more complete gelation of the composition so that more ungelled material is incorporated into the gel structure in the at least one exposed region than in the non-exposed regions, and (5) extracting / removing material not incorporated into the gel structure at least from the region(s) not exposed to the conditions of step (4) in order to produce a ridge waveguide (Abstract, Figures 2, 5a,

and 5b, Col.1, lines 9 – 16, Col.2, Col.3, lines 1 – 33, Col.4, lines 19 – 35, Col.5, lines 19 – 67, and Col.6, lines 1 – 24). Fardad et al. does not explicitly teach that the process, specifically the extraction / removal of material not incorporated in the gel structure, produces a material with at least two regions of differing refractive index (i.e., a refractive index difference between the material of the at least one exposed region and the material of the non-exposed regions). Specifically, Fardad et al. teaches completely removing the non-exposed regions of the sol-gel film to produce a ridge waveguide (Abstract, Figure 5a, Col.2, lines 20 – 26, and Col.5, lines 63 – 65). However, this removal process of Fardad et al. is not instantaneous – it takes place over the course of "a few minutes" while the coated substrate is soaked in a solvent (Col.5, lines 63 – 65). As such, <u>at any point in the soaking process prior to completely removing the non-exposed regions of the film</u>, the waveguide of the process of Fardad et al. would inherently comprise at least two regions of differing refractive index (i.e., a refractive index difference between the material of the at least one exposed region and the material of the non-exposed regions, as required by the claims) because the partially dissolved, non-exposed regions would have a different composition and physical structure (i.e., due to the removal of the ungelled material from these regions), and therefore a different refractive index, than the exposed regions which are not being dissolved by the solvent.

16. Fardad et al. also teaches all the limitations of **Claims 2 – 13, 16, 18, and 21** as set forth above in paragraph 15 and below, including a method wherein / further comprising:

- Claim 2: A second component is provided together with the gelable component, the second component being selected to impart a higher or lower refractive index to that part of the material in which it is incorporated (Col.3, lines 7 – 10, Col.5, lines 19 – 25).
- Claim 3: The material is provided with a step in refractive index between at least two regions of the material. Specifically, as set forth above in paragraph 15, Fardad et al. teaches all the process steps and limitations of the applicant's claims, including removing material not incorporated in the gel structure from the non-exposed regions. Unless essential process steps and/or limitations are missing from the applicant's claims, this removal of material taught by Fardad et al. would have inherently produced a refractive index step between the exposed regions (i.e., the regions not being dissolved) and the non-exposed regions (i.e., the regions being dissolved) due to the compositional and structural differences between the undissolved exposed regions and the partially dissolved non-exposed regions.
- Claims 4 – 6: An amount of second component not bound in the material and an amount of ungelled gelable component are extracted by a solvent in the removal step. Specifically, Fardad et al. teaches completely removing the non-exposed regions of the sol-gel film (i.e., which contain both an amount of second component and an amount of ungelled material) to produce a ridge waveguide by soaking in a solvent such as n-propanol (Abstract, Figure 5a, Col.2, lines 20 – 26, and Col.5, lines 63 – 65).

- Claims 7 – 8: The gelable component is selected from those which are susceptible to cross-linking, and the discrete region(s) exposed to the conditions have cross-linked to a greater extent (Col.2, lines 31 – 67, Col.3, lines 1 – 10, and Col.5, lines 59 – 62). Specifically, the gelable component of Fardad et al. is a photosensitive sol-gel, a material susceptible to cross-linking (see, for example, Sara et al. ("Photolithography Fabrication of Sol-Gel Ridge Waveguide", July 1998), page 119, second full paragraph, which is cited to show that a sol-gel material such as that of Fardad et al. is susceptible to cross-linking).
- Claims 9 – 11: The gelable component is gelable by irradiation and/or exposure to elevated temperatures, particularly UV irradiation, and a mask is used to expose at least one discrete region of the partially gelled composition to conditions which induce more complete gelation of the partially gelled composition (Abstract, Figure 2, Col.5, lines 36 – 42 and 51 – 62).
- Claim 12: The gelable component is selected from alkyl or acyl substituted alkoxysilanes, including those listed by the applicant (Abstract, Col.2, lines 46 – 47, and Col.4, lines 59 – 61).
- Claim 13: The exposed region has a greater amount of second component bound in the gel and has a higher refractive index than the non-exposed region with lesser amounts of the second component bound in the gel, at a desired wavelength (i.e., any wavelength). Specifically, the refractive index modifier of Fardad et al. is, for example, a zirconium alkoxide (Col.3, lines 9 –

10, Col.5, lines 19 – 25), which inherently increases the refractive index of the silica-based gelable composition due to its higher refractive index when compared to silica (also, see page 17, lines 4 – 8, of the applicant's specification, which indicates that zirconium compounds qualify as high refractive index components in the applicant's process). Additionally, since the process of Fardad et al. dissolves and removes the entire non-exposed region(s) of the waveguide, the exposed regions (which are not dissolved) would have inherently contained a greater amount of second component bound in the gel because the second component in the non-exposed region(s) is completely removed by the solvent throughout the course of the process of Fardad et al.

- Claim 16: The second component is capable of being bound in the gel structure. Specifically, the refractive index modifier (second component) of Fardad et al. is, for example, a zirconium alkoxide (Col.3, lines 9 – 10, Col.5, lines 19 – 25), which is inherently capable of being bound in the gel structure (i.e., due to its alkoxide structure and the fact that alkoxides can be bound in sol-gels).
- Claim 18: The refractive index of the exposed region(s) and the non-exposed region(s) is in the range of about 1 to about 6 (Col.7, lines 22 – 25).
- Claim 21: Providing a protective layer or coating for the material (Figure 2, step number "28"; Col.2, lines 29 – 30, and Col.6, lines 7 – 24).

17. Claims 1 – 4, 7 – 11, 13, 16, 20, and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Okaniwa (USPN 5,694,513).

18. Regarding independent **Claims 1 and 20**, Okaniwa teaches a process for forming an optical waveguide (Abstract), the process comprising the steps of (1) forming a buffer layer on a desired substrate (Col.7, lines 54 – 67, Col.8, lines 1 – 41), (2) applying a "gelable composition comprising a gelable component" (i.e., a photosensitive fluorinated polyimide material) to the buffer layer so that the gelable composition is in a desired form, (3) exposing the gelable composition to conditions which partially gel the gelable composition so that an amount of ungelled material remains (i.e., the heating / solvent evaporation step), (4) exposing at least one discrete area of the partially gelled product to conditions which induce more complete gelation of the composition so that more ungelled material is incorporated into the gel structure in the at least one exposed region than in the non-exposed regions, and (5) extracting / removing material not incorporated into the gel structure at least from the region(s) not exposed to the conditions of step (4) in order to produce a difference in the refractive index between the exposed area and the unexposed area (Abstract, Col.2, lines 39 – 67, Col.4, lines 45 – 57, Col.7, lines 46 – 67, Col.8, lines 1 – 67, Col.9, lines 1 – 27, and Example 5). The examiner notes that a purely organic material such as the polyimide material taught by Okaniwa is not typically considered to be a "gelable composition" as required by the applicant's claims. However, it is clear from the applicant's specification that such a "wholly organic system" is intended to be within the scope of the applicant's claimed

invention (see Example 4 on page 28 of the applicant's specification), and as such, the process of Okaniwa anticipates the applicant's claimed process as set forth above.

19. Okaniwa also teaches all the limitations of **Claims 2 – 4, 7 – 11, 13, 16, and 21** as set forth above in paragraph 18 and below, including a method wherein / further comprising:

- Claim 2: A second component is provided together with the gelable component, the second component being selected to impart a higher or lower refractive index to that part of the material in which it is incorporated (Col.8, lines 55 – 67, Col.9, lines 1 – 27).
- Claim 3: The material is provided with a step in refractive index between at least two regions of the material. Specifically, as set forth above in paragraph 18, Okaniwa teaches all the process steps and limitations of the applicant's claims, including removing material not incorporated in the gel structure from the non-exposed regions (e.g., by heating) to produce a difference in the refractive index between the exposed area and the non-exposed area(s). As such, unless essential process steps and/or limitations are missing from the applicant's claims, this removal of material taught by Okaniwa would have inherently produced a refractive index step between the two regions due to the difference in refractive index between the regions.
- Claim 4: An amount of second component not bound in the material is extracted by the removal step (Col.4, lines 54 – 57, Col.8, lines 45 – 50).

- Claims 7 – 8: The gelable component is selected from those which are susceptible to cross-linking, and the discrete region(s) exposed to the conditions have cross-linked to a greater extent (Col.2, lines 31 – 67, Col.3, lines 1 – 10, and Col.5, lines 59 – 62). Specifically, the gelable component of Okaniwa is a photosensitive fluorinated polyimide, a material susceptible to cross-linking that is cross-linked (e.g., with the low molecular weight additive) during the light exposure step (Col.8, lines 55 – 67, Col.9, lines 1 – 27.
- Claims 9 – 11: The gelable component is gelable by irradiation and/or exposure to elevated temperatures, particularly UV irradiation, and a mask is used to expose at least one discrete region of the partially gelled composition to conditions which induce more complete gelation of the partially gelled composition (Col.4, lines 52 – 57, Col.8, lines 42 – 50, and Col.10, lines 53 – 56). Please note that light from a high-pressure mercury lamp, as taught by Okaniwa, is UV light (see Maruo et al. (USPN 5,572,619) (Col.9, lines 19 – 22), which is cited simply to show that mercury lamps give off UV light).
- Claim 13: The exposed region has a greater amount of second component bound in the gel and has a higher refractive index than the non-exposed region with lesser amounts of the second component bound in the gel, at a desired wavelength (i.e., any wavelength) (Col.8, lines 49 – 50, Col.9, lines 4 – 27).
- Claim 16: The second component is capable of being bound in the gel structure (Col.8, lines 55 – 67, Col.9, lines 1 – 27).

- Claim 21: Providing a protective layer or coating for the material (e.g., an upper cladding layer) (Col.8, lines 51 – 54, Col.10, lines 59 – 63).

Claim Rejections - 35 USC § 103

20. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

21. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

22. Claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fardad et al. (USPN 6,054,253) in view of Dawes et al. (USPN 6,144,795) and Anderson et al. (USPN 5,169,576).

23. Fardad et al. teaches all the limitations of **Claims 14 and 15** as set forth above in paragraphs 15 and 16, except for a process wherein the second component (i.e., the

refractive index modifier) comprises solid particles provided as a dispersion in the gelable component (i.e., the photosensitive sol-gel material). However, Fardad et al. does teach adding zirconium propoxide as a refractive index modifier and that, "Those of ordinary skill in the art know that the introduction of a refractive index modifier can improve the performance or adjust the characteristics of ridge waveguides" (Col.5, lines 19 – 26). This teaching indicates that Fardad et al. is open to incorporating a refractive index modifier in general into the photosensitive sol-gel material. Dawes et al. teaches that, in the art of making optical waveguides, metal alkoxides (e.g., Zr, Ti, etc. alkoxides) can be included in the core composition in order to increase the refractive index of the core, and the alkoxides can be hydrolyzed to their hydrolysis products (Col.7, lines 52 – 67). Anderson et al. teaches that, in a sol-gel process, metal alkoxides form particles upon hydrolysis and remain in suspension (Col.1, lines 52 – 68, Col.2, lines 1 – 5, and Col.3, lines 5 and 56 – 58). It would have been obvious to one of ordinary skill in the art to add a hydrolyzed metal alkoxide (i.e., metal oxide particles in suspension, as taught by Anderson et al.) as the refractive index modifier to the sol-gel material in the process of Fardad et al. with the reasonable expectation of successfully and advantageously controlling the refractive index of the material, thereby improving the performance and/or adjusting the characteristics of the waveguide, as taught by Fardad et al. One of ordinary skill in the art would have done so with the reasonable expectation of obtaining similar results, regardless of whether the modifier was added as a metal

alkoxide (as taught by Fardad et al.) or as metal oxide particles in a dispersion obtained by hydrolyzing the alkoxide (as taught by Dawes et al.).

24. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fardad et al. (USPN 6,054,253) in view of Dawes et al. (USPN 6,144,795).

25. Fardad et al. teaches all the limitations of **Claim 17** as set forth above in paragraphs 15 and 16, except for a process wherein the second component (i.e., the refractive index modifier) is selected from the group of alkyl or acyl substituted alkoxy silanes including the compounds recited by the applicant. However, Fardad et al. does teach that, "Those of ordinary skill in the art know that the introduction of a refractive index modifier can improve the performance or adjust the characteristics of ridge waveguides" (Col.5, lines 19 – 26). This teaching indicates that Fardad et al. is open to incorporating a refractive index modifier in general into the photosensitive sol-gel material. Dawes et al. teaches that, in the art of making optical waveguides from a material analogous to that of Fardad et al., phenyltrialkoxysilanes such as phenyltriethoxysilane (PTES) can be incorporated into the core material in order to vary / increase the refractive index of the material (Col.8, lines 1 – 6, Col.12, lines 14 – 36 and 65 – 66). Therefore, it would have been obvious to one of ordinary skill in the art to incorporate a phenyltrialkoxysilane such as phenyltriethoxysilane (PTES) into the photosensitive sol-gel composition of Fardad et al. with the reasonable expectation of successfully and advantageously controlling the refractive index of the material by using a compound that is capable of doing so (e.g., PTES), thereby

improving the performance and/or adjusting the characteristics of the waveguide, as desired by Fardad et al. Please note that the selection of a known material based on its suitability for its intended use is *prima facie* obvious (MPEP 2144.07).

26. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fardad et al. (USPN 6,054,253) in view of Coudray et al. ("Integrated optics based on organo-mineral materials", European Materials Conference, June 1999).

27. Fardad et al. teaches all the limitations of **Claim 19** as set forth above in paragraphs 15 and 16, except for a process wherein the difference in the refractive index of the exposed region(s) and the non-exposed regions is in the range from about 0.001 to about 0.5. Specifically, Fardad et al. is silent regarding the refractive index difference between the two regions. However, it is the overall goal of Fardad et al. to produce an optical waveguide by using a photosensitive sol-gel material and exposing portions of the material to UV light (Abstract). Coudray et al. teaches an analogous process of producing an optical waveguide from the same photosensitive sol-gel material taught by Fardad et al. and teaches that the local index change (i.e., the difference in the refractive index of the exposed region(s) and the non-exposed regions) can be selected to be between 0.0001 and 0.03 (i.e., a range overlapping the applicant's claimed range) by suitable UV polymerization ("Fabrication" and "Qualities of the organo-mineral layer" sections). Therefore, it would have been obvious to one of ordinary skill in the art to carry-out the UV exposure process of Fardad et al. to achieve a local index change of, for example, between 0.0001 and

0.03 because Fardad et al. is silent regarding the local index change and Coudray et al. teaches that such an index change / refractive index difference is suitable for producing an optical waveguide in the manner and from the materials taught by Fardad et al.

28. Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okaniwa (USPN 5,694,513) in view of Matsuura et al. (USPN 5,108,201).

29. Okaniwa teaches all the limitations of **Claims 18 and 19** as set forth above in paragraphs 18 and 19, except for the limitations that the refractive index of the exposed and non-exposed regions is in the range of about 1 to about 6, and the refractive index difference between the regions is from about 0.001 to about 0.5. Specifically, Okaniwa is silent regarding the refractive index and the refractive index difference of the exposed and non-exposed regions of the photosensitive polyimide waveguide. Matsuura et al. teaches that, in the art of producing polyimide optical waveguides, the refractive index of the core and the cladding should be controlled to be within the range of 1.49 to 1.71, particularly 1.49 to 1.65 (i.e., a range entirely within the applicant's claimed range), and it is important to control the core-cladding refractive index ratio (Col.1, lines 7 – 10 and 20 – 23, Col.2, lines 29 – 39 and 50 – 51, Col.10, lines 32 – 37, and Tables 1-1 and 1-2). Therefore, it would have been obvious to one of ordinary skill in the art to control the refractive index of the exposed and non-exposed regions in the process of Okaniwa to be in the range of 1.49 to 1.71, particularly 1.49 to 1.65 (as taught by Matsuura et al.), as well as to

control the refractive index ratio (i.e., the refractive index difference) between the exposed and non-exposed regions with the reasonable expectation of successfully and advantageously producing a structure having a core and cladding with a refractive index and refractive index difference sufficient to allow the structure to function as an optical waveguide, as desired by Okaniwa.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Fan et al. (USPN 5,054,872) teaches a method of making a polymeric optical waveguide having regions of different refractive index due to different degrees of polymerization. Mir et al. (USPN 5,064,684) teaches making a waveguide by depositing a liquid organo-metallic precursor layer on a substrate, heating the layer to harden it, and then locally heating a selected area to alter the refractive index. Mendoza et al. (US 2003/0210881 A1) teaches making a waveguide by depositing a photosensitive sol-gel film on a substrate, exposing the film to UV radiation in a desired pattern, and then performing two heating steps to remove constituents from the exposed regions and produce a metal oxide patterned waveguide material.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D Markham whose telephone number is (571) 272-1422. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (571) 272-1415. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Wesley D Markham
Examiner
Art Unit 1762

WDM
WDM

SHRIVE P. BECK
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700